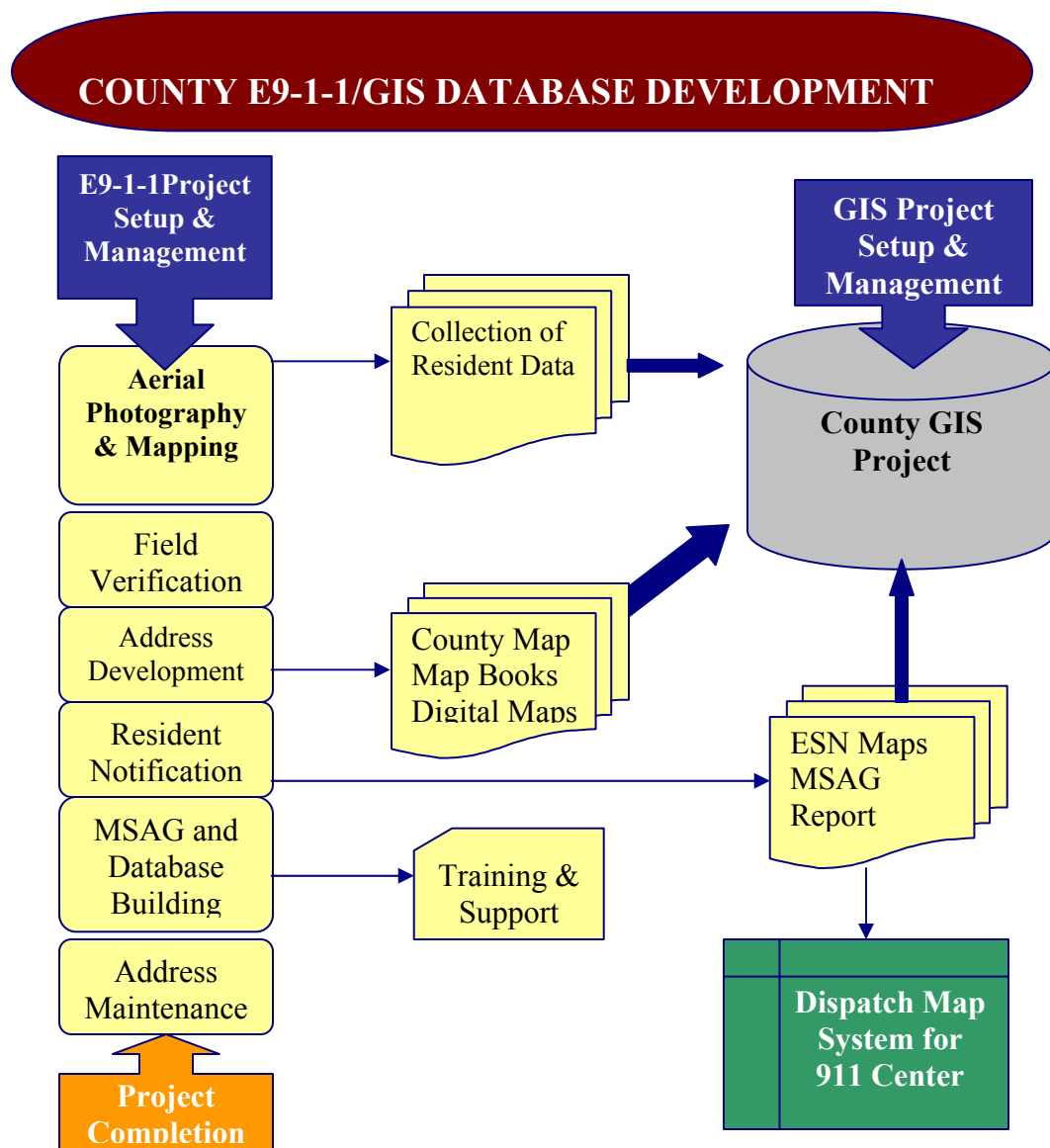


The Basics of a 911 Mapping and Addressing Project using VGIN Statewide Mapping as Source

Future Growth – The Importance of GIS. In most counties, the main Geographic Information System (GIS) application links property maps (parcels, lots, etc.) with tax assessments, land use, zoning restrictions, and ownership records. Beyond that, the potential for GIS applications is virtually unlimited. A Geographic Information System is successful when it comprehensively and consistently meets the needs of its users. Development of a successful GIS depends on well-defined user requirements which can often be determined during the implementation of a 911 addressing project, particularly in a rural county that does not have a mature GIS.



Spatial Data

Creating a uniform addressing system with base mapping requires the accurate location of all road centerlines. Accurate road centerlines are essential to effective E-911 mapping applications. Additional layers that are helpful, but not critical include: building locations, driveways, boundary information, fire hydrants, hydrography, bridges, etc. These layers add to the effectiveness of address maps. Driveway entrances to each structure should be properly depicted on a map, so emergency response can access the building most efficiently. This is typically a bigger concern for the rural counties in the state.

Also it is important to be aware that relying on geocoded address ranges along roads will inevitably cause inherent errors in where structures are "positioned" along a road. These addresses could be inaccurate by as much as several hundred feet or more. This would NOT be reliable data for 911 response. The reason behind this is due to a pre-calculated distance between the high and low addresses on a street. To apply a simple mathematical formula to determine location on a road segment is not necessarily going to be accurate.

Attribute Data

Each road centerline segment requires the following attributes: road name, low address and high address. Additional information such as route numbers, zip codes, emergency service zones and telco exchanges boundaries are required to provide the databases for Enhanced 911. These database layers are the key components that go into developing the Master Street Address Guide (MSAG).

Data Acquisition Options

Utilizing the VBMP Digital Orthophotos, each road centerline should be digitized using digital mapping methods to create road centerlines that match the Orthophotos spatially. All new roads should be added using GPS collection to ensure accurate curvature and shape. Each addressed structure should be located and digitized from the Orthophoto.

Data Conflation Options

For jurisdictions that have already completed an address conversion project, the possibility exists for the base mapping not to match the VBMP Digital Orthophotos exactly. This is due to the differences in control networks used to create each project. However, the VBMP Digital Orthophotos provide an excellent source to verify and correct any roads and addressed structures that were added using field measurements. It is also possible that a base mapping dataset is on a different mapping projection. The VBMP Digital Orthophotos are created using the NAD 83 US-FOOT projection. If a base mapping dataset was created on NAD 27 or using metric units, it will need to be re-projected to the NAD 83 projection. The NAD 83 projection for Virginia is split into North and South.

GUI / Programming Options – For E-911 Dispatch

Map Locating Software for Dispatch A computer map locating system that supports the Telco's ANI/ALI System is now becoming a requirement for meeting the FCC mandates for locating wireless 911 calls. A qualified mapping display system should be ready and equipped to meet the Wireless Phase I and Phase II mandated standards.

Any locating software being considered should have these minimum capabilities:

- Location of an address using address point information
- Location of an address using geocoding techniques along a road centerline
- Location of a road intersection using the road centerline data
- Location of a Long/Lat point
- The ability to handle multiple calls at once
- Return information based upon polygon analysis

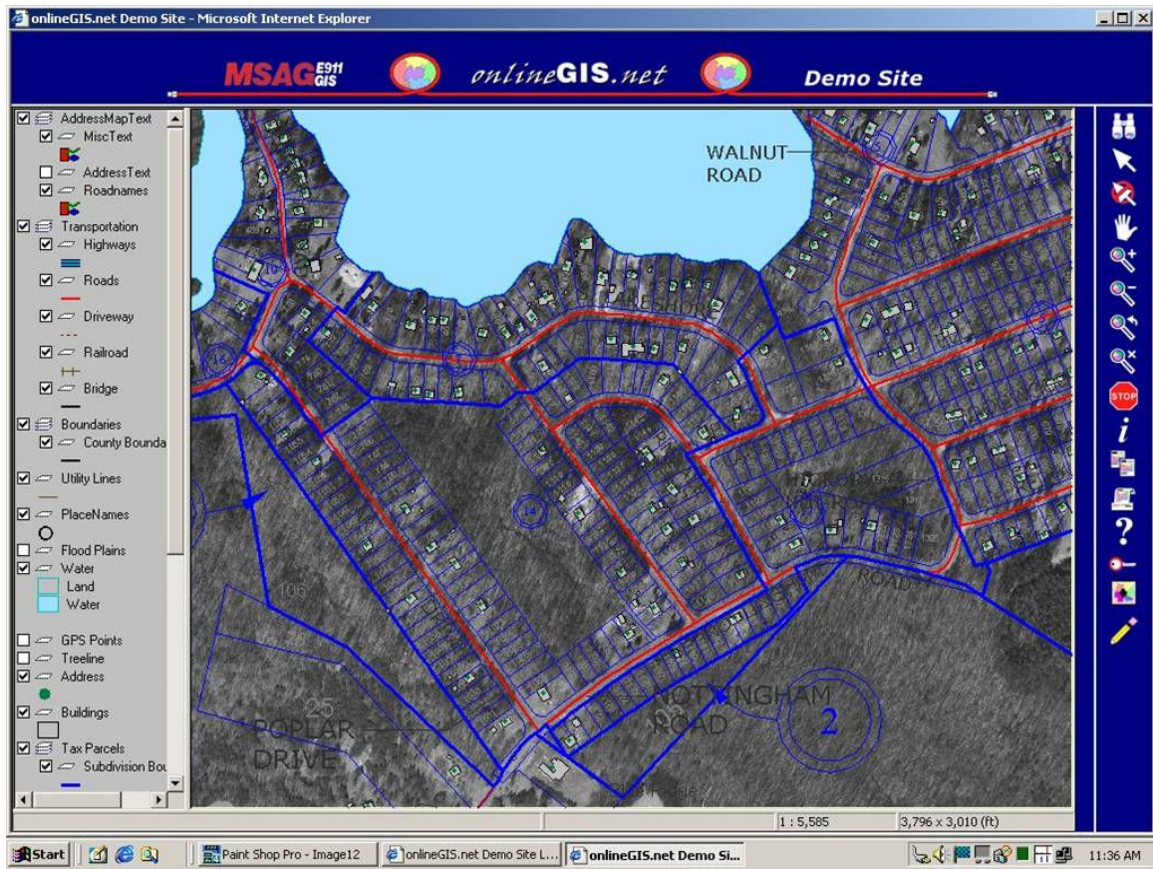
See page 9 for more information on map locating software.

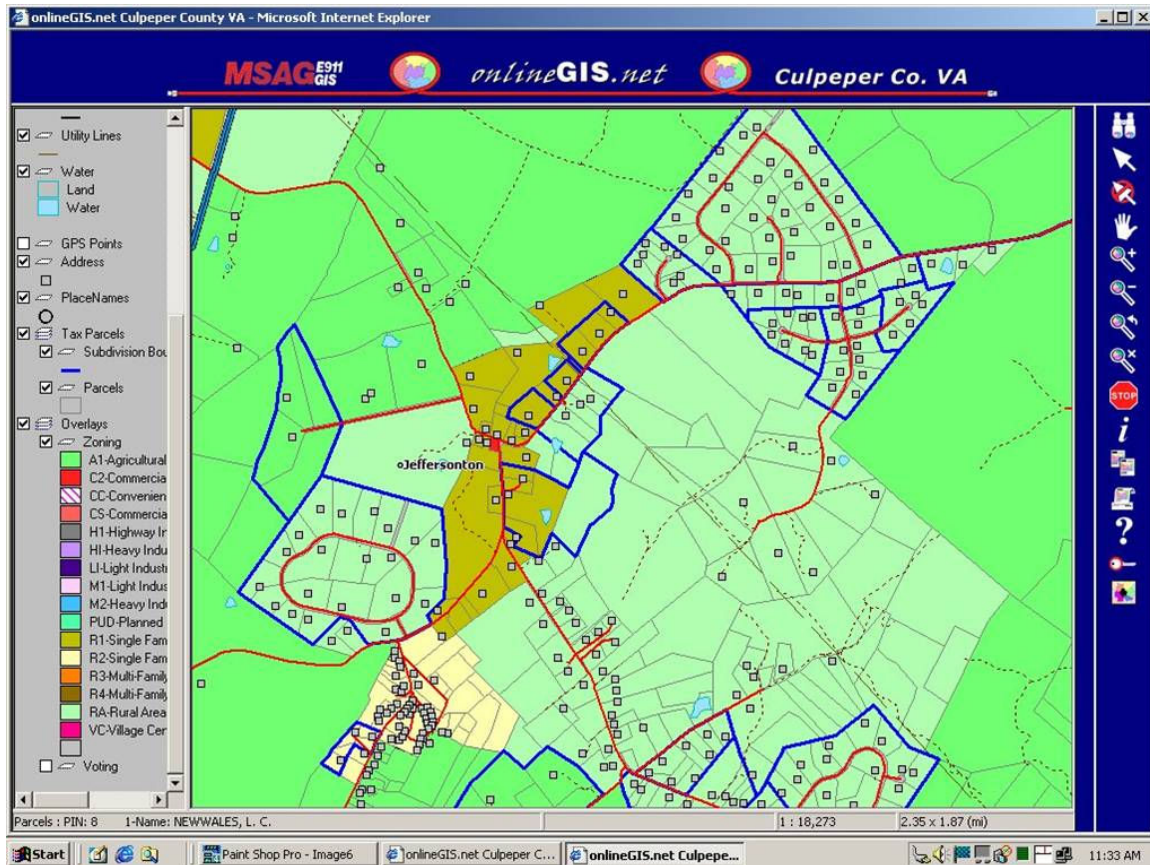
Internet Functionality and Options

Making address information available via the World Wide Web is the easiest and fastest way to allow everyone to have access to address information. There are simple to use Internet solutions available to allow residents and county employees to quickly locate an address and see the physical location on a map. From the user standpoint, there is no software to purchase. Standard Internet browsers work with free plug-in applications to view the map data over any type of connection to the Internet (from dial-up to broadband). To host map data on the Internet there are many considerations involved. A long-range plan for implementing Internet servers, firewalls, etc needs to be in place along with the technical staff to manage them on a daily basis. Typically, most jurisdictions do not have the time, manpower with the needed expertise, or hardware infrastructure to adequately manage a complex Internet application such as this. Some of the larger localities have developed Internet applications in-house, but it most likely suitable for many localities to use a qualified vendor to host the data on the web.

Case study: Bedford County – contact John Barrett – 911 Coordinator and Carl Levandoski – GIS Coordinator.

Bedford County uses OnlineGIS.net in their Dispatch Center as an aid in referencing properties for an emergency. The County uses the Internet site as a supplemental tool to their map locating system. Useful information that is available online includes tax parcel lookup, and other custom GIS queries.





Technical Requirements

To successfully complete addressing, a field visit is required to every road and driveway in the county or city. The physical length of each road needs to be determined. Each structure needs to be investigated to see if an address is required. Once this comprehensive fieldwork is complete, address assignment can be started. A major step to an accurate and effective addressing system involves field verification of addressable structures. Through Field Verification, a contractor should identify roads requiring names, perhaps capturing any state-maintained roads that were previously missed or contain duplicate names. This typically involves consultation with the committee responsible for assigning names to unnamed public roads. With citizen cooperation, there are effective ways to assign names to private roads. In most instances, private roads with three or more buildings on them require structure address numbers. Existing structure numbers already established in towns or subdivisions may not need to change, but should be examined to determine suitability for the locality's E9-1-1 System.

Administrative / Management Requirements

Most jurisdictions utilize an outside vendor to complete this project. Each jurisdiction is required to supply road names and emergency service responder boundaries to complete any addressing project. All named roads require the approval of the governing body to make them official. Each newly named street (both public and private) also requires the installation of road signs. There is long-term management involved in addressing also. It is necessary to maintain the address scheme by continually adding the new information and removing information that goes out of date.

The image displays three documents related to the E9-1-1 Confidential Questionnaire. On the left is a cover sheet titled "YOUR NEW ADDRESS:" with fields for "SHEET NO." and "DATE". In the center is the "9-1-1 CONFIDENTIAL QUESTIONNAIRE" form, which includes sections for "PLEASE PRINT", "Your Telephone Number", and "Your Name and Current Mailing Address". On the right is a vertical sign with a circular hole at the top and the text "9-1-1 INFORMATION" in large red letters.

Database Compilation & Cooperation with the Post Office and Telephone Company. From Confidential Questionnaires, the contractor should compile the E9-1-1 Master Street Address Guide, Old/New Address List, and Road Name Roster in electronic media and/or hard copy. Working with the Post Office and the local telephone company — and providing them with necessary database lists is very important.

Address Maintenance & Training. Address Maintenance to keep the County's maps up to date is key to long term success. It is often required that government personnel be trained in carrying out the Address Maintenance procedures. Software programs are available that can make maintenance and management easier. Below is an example of a GUI developed by MSAG Data Consultants.



The average locality in Virginia can expect to pay from \$100,000 to \$200,000 for complete addressing services. Other costs to consider include Road signage, and temporary address plates during the addressing process. A major cost savings for localities today is obtaining new VBMP aerial photography to update the planimetric mapping. For an average county this is a savings of \$80,000 to \$120,000.

The National Emergency Number Association (NENA) recommends the usage of a mile marker addressing scheme. This mile marker system has each road start at a zero point and uses a foot interval for addressing. Typically this is one address every 5.28 feet, or every 52.8 feet, etc. For example, when using one address every 5.28 feet, each mile of road has 1000 addresses (500 odd and 500 even). Even numbers should be to the right as the address values increase and odd numbers to the left. With this method numbers are reserved for future growth and will not disrupt numbers previously assigned under the mile-marker system. A good contractor will also address free-standing outdoor pay telephones and locate fire hydrants on maps.

Startup Procedures / Steps

To begin the assignment of addresses, each jurisdiction should begin with a complete project of naming all roads. Each highway, road and subdivision road should have a unique name. Address ranges can then be tied into the road centerline data created from the Digital Orthophotos. There should also be ordinances in place that govern the guidelines for road names, road signs and address number display.

Estimated Time Line and/or Implementation Schedule

Utilizing the VBMP Digital Orthophotos, the time frame for a jurisdiction to complete an address conversion project will range from six to twelve months. Additional time will be needed by other agencies (such as the US Postal Service and Telephone Companies) to get an E9-1-1 system online. If the road naming process is completed in a locality, the time to complete a project may take as little as six months. In most cases, successfully adopting official road names is key to meeting a short timeline.

Best Practice Examples in Virginia

Botetourt County
Culpeper County
Fluvanna County
Louisa County
Mathews County
Madison County
Orange County
Spotsylvania County

Botetourt County, VA

Contact : Spencer Suter – GIS-Communications Manager

MSAG Data Consultants performed a complete 911/GIS project including Aerial Photography, Planimetric mapping, 911 Addressing, Parcel Conversion and Rectification, Address Maintenance System, and EAGLE Dispatching Software.

Fluvanna County, VA

Contact: Garland Nuckols - 911 Communications Manager

MSAG Data Consultants performed a complete 911 project including Aerial Photography, Planimetric mapping, 911 Addressing, Ortho Photography, EAGLE Dispatching Software and OnlineGIS.net.

Amherst County, VA**Contact: Jack Ball – Emergency Services Coordinator**

MSAG Data Consultants performed Address Remediation Services from existing county mapping and field verification. Deliverables included Planimetric Mapping, Corrected 911 Addressing, EAGLE Dispatching Software and OnlineGIS.net.

Bedford County, VA**Contact: Carl Levandoski – GIS Coordinator**

MSAG Data Consultants performed address remediation services from existing county mapping and field verification. Deliverables included Planimetric Mapping, Corrected 911 Addressing, Parcel Conversion and Rectification, Address Maintenance System, ARC/INFO Parcel Maintenance System, custom ArcViewGIS Extension, EAGLE Dispatching Software and OnlineGIS.net.

Culpeper County, VA**Contact: Pamela Schiermeyer – GIS Coordinator**

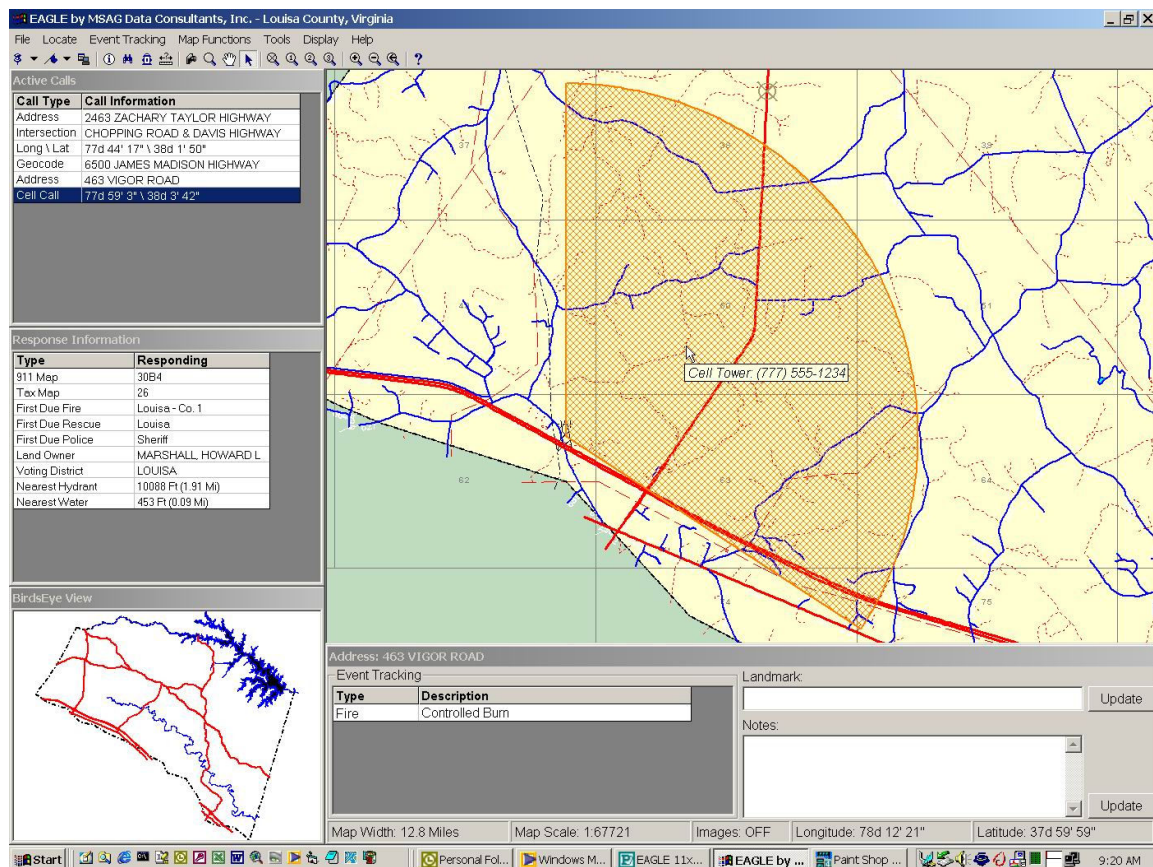
MSAG Data Consultants performed a complete 911 project including Aerial Photography, Planimetric mapping, 911 Addressing, Address Maintenance System, ARC/INFO Parcel Maintenance System, custom ArcViewGIS Extension and OnlineGIS.net.

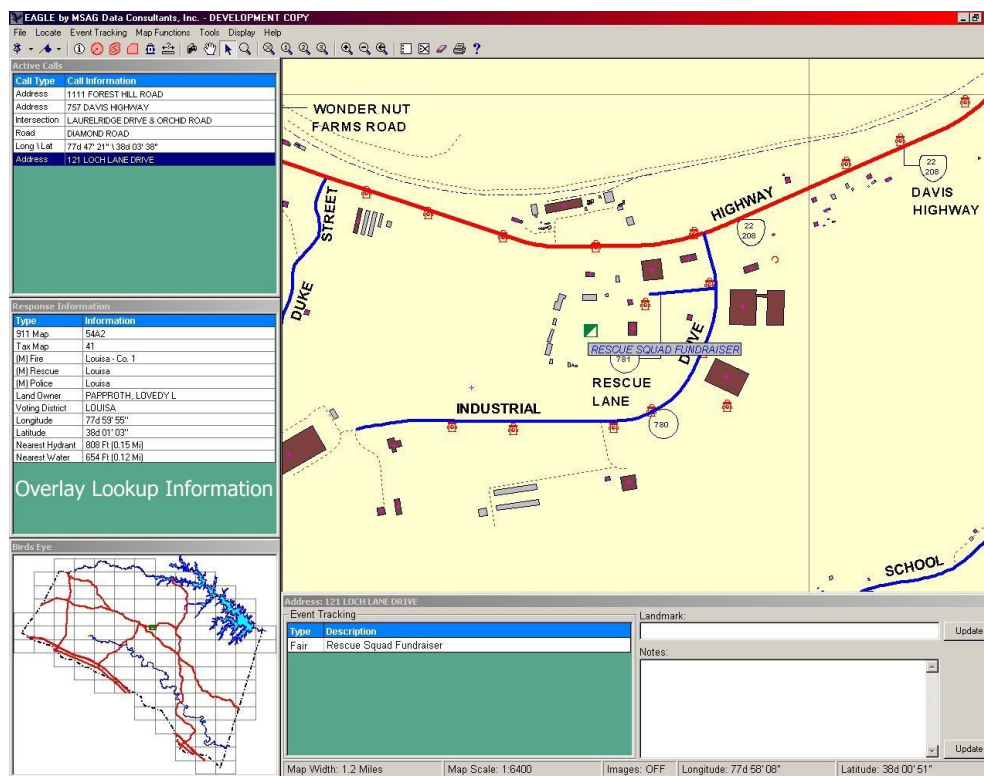
E-911 Dispatch – An increasingly important application for GIS

GUI / Programming Options

There are several quality dispatch map software products available today for PSAPs (Public Safety Answering Points). Some mapping products come in the form of CAD-bundled packages, others are available by the Phone equipment manufacturer, and still others have customizable functionality designed to run as standalone or with the Phone or CAD equipment.

When evaluating dispatch mapping software, in addition to the minimum GUI programming functions listed on page 3, other desired capabilities may be: performing address searches (exact point locations, geocoded addresses, road locations, road intersections, landmark locations, and longitude/latitude locations), performing overlay lookup information for every located address using as many polygon overlays as desired. In a few software packages in the industry, overlay lookups can be customized for each department by utilizing a built-in layer manager to add / remove polygons from various data sources including ArcView shapefiles and ArcInfo Coverages. Some software packages will support the VGIN-supplied orthophotography as a backdrop to any map dataset. In addition, the hydrography data supplied through VGIN can to be used especially for displaying potential water sources for fire response.





Technical Requirements

The use of a PC network will give all dispatch solutions to most powerful solution for E-911 dispatching. The PC is an ever-changing device. It is highly recommended to purchase the newest and fastest PC at the time of installation. This does not end with installation. A locality should budget to keep new machines in dispatch every 2-3 years.

Administrative / Management Requirements

The use of digital mapping to aid E-911 is a relatively new idea. The most important aspect of managing this data is to keep it current at all times. The use of a GPS system and mapping department will be a long-term need. Each new road and address needs to be constantly added to the map data otherwise, the system will eventually break down and fail.

Cost – Cost/Benefit

The ability to locate street addresses on a map allows a dispatcher some power of GIS at his/her fingertips and can aid in some E-911 calls. However, with the wireless 911 initiative, the need for digital mapping is a must. Once it is implemented, wireless 911 will supply map coordinates that only a computer can locate efficiently. The cost of a dispatching solution depends on the size of the dispatch center and the number of licenses needed of the software. Costs for E-911 mapping systems can be paid for by using the E-911 surcharge (enacted and established by the Board of Supervisors) or money from the E-911 wireless board. Software license fees can range anywhere from \$2000 per user license to \$20,000 depending on manufacturer. The cost spectrum is wide, but be aware

that cost does NOT always equate with functionality and quality. Each dispatch center is unique, and has different needs in order to best serve the locality.

Standards / Guideline Summary

For this application, speed and accuracy are the keys. The system must be able to quickly and accurately locate the caller.

FCC Phase I E-911 Wireless Requirements:

As of 1998, wireless carriers are required to provide to the PSAP the telephone number of the originator of a 911 call and the location of the cell site or base station receiving a 911 call. This information assists in the provision of timely emergency responses both by providing some information about the general location from which the call is being received and by permitting emergency call-takers to re-establish a connection with the caller if the call is disconnected.

FCC Phase II E-911 Wireless Requirements:

The FCC mandate states that for PSAPs with Network-Based ALI Technology: Carriers employing network-based location technologies must provide Phase II information for at least 50 percent of the PSAP's coverage area or population.

Within 18 months of a PSAP request, carriers must provide Phase II information for 100 percent of the PSAP's coverage area or population.

ALI Accuracy Standards: The FCC adopted the following revised standards for Phase II location accuracy and reliability:

1. For handset-based solutions: 50 meters for 67 percent of calls, 150 meters for 95 percent of calls
2. For network-based solutions: 100 meters for 67 percent of calls, 300 meters for 95 percent of calls

Internet Functionality and Options

Due to the critical nature of E-911 dispatching, the use of Internet technology as the primary means to locate emergency callers is not highly recommended. However, within the dispatch center the Internet can be used to view some data and reduce costs for non-dispatch personnel.

Startup Procedures / Steps

The ideal place to start is with an address conversion project. If a jurisdiction is already addressed 100%, they will need to verify that they have the information available in a format that can be used by the E-911 dispatch center. Also, an inventory of existing

software and hardware needs to be taken to determine what might be needed to support a Dispatch Mapping Display system. This may involve evaluating current 911 phone equipment technology capabilities as well as Computer Aided Dispatch (CAD) equipment capabilities and upgrade requirements. In addition, a jurisdiction should always check with internal departments that may have existing map data that can aid in dispatch.

Estimated Time Line and/or Implementation Schedule

Once the address project is completed, the time to install a map locating system should be very short. Conservatively, one to two months is all that is needed to build the initial data sets, install and train employees in its use.

Best Practice Examples in Virginia

Amherst County
Bedford County
Botetourt County
Fluvanna County
Greene County
King George County
Louisa County
Lunenburg County
Middlesex County
Orange County
Richmond County
Spotsylvania County
Southampton County
Westmoreland County